Alsea Bay Bridge
Spanning Alsea Bay on the Oregon Coast Highway
Waldport
Lincoln County
Oregon

HAER OR-14

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Historic American Engineering Record
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HISTORIC AMERICAN ENGINEERING RECORD

ALSEA BAY BRIDGE
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Location:	Spanning Alsea Bay on the Oregon Coast Highway, Waldport, Lincoln County, Oregon UTM: Waldport, Oregon Quad. 10/414890/4920160
Date of Construction:	1934-1936
Structural Type:	Reinforced-concrete through tied arch
Engineer:	Conde B. McCullough, Oregon State Highway Department
Builder:	Lindstrom and Feigenson, Portland, Oregon Parker & Banfield, Portland, Oregon T.H. Banfield, Portland, Oregon
Owner:	Oregon Department of Transportation
Past Use:	Vehicular and pedestrian bridge
Present Use:	Demolished in 1991
Significance:	The Alsea Bay Bridge was one of five large spans built along the Oregon Coast Highway between 1934 and 1936, of which C.B. McCullough oversaw the design and construction. The main spans of this 3,028-foot structure are three reinforced-concrete through tied arches. These arches are the largest of McCullough's reinforced-concrete tied arches in the state. Alsea Bay Bridge is the third largest of the five Oregon Coast Highway bridges. It is considered by some experts to rank among the finer examples of concrete bridges in America and may be the longest concrete span in North America. The bridge is significant for its impressive design and ornate detailing in the Art Deco style. Construction of a replacement bridge began in 1988, and was completed in 1991. The original structure was subsequently demolished.
Project Information:	Documentation of the Alsea Bay Bridge is part of the Oregon Historic Bridge Recording Project, conducted during the summer of 1990 under the co-sponsorship of HABS/HAER and the Oregon Department of Transportation. Researched and written by Kenneth J. Guzowski, HAER Historian, 1990. Updated by Robert W. Hadlow, 1992. Edited and transmitted by Lola Bennett, HAER Historian, 1992.
Related Documentation:	For more information on Conde B. McCullough, see HAER OR-54.

HISTORY

The central portion of the Oregon Coast Highway was completed in the mid 1930s with the construction of the Alsea Bay bridge and four other large coastal bridges. These multi-span bridges range in length from 1,650' to 3,337'. Each utilizes arch forms of reinforced concrete or combinations of concrete and steel.

The Oregon Coast Highway was constructed in piecemeal fashion beginning in Clatsop County in 1914. Sections of the highway were constructed north and south from the cross-mountain roads. Limited funds prohibited rapid development of the coast highway, however, in 1919 the Oregon legislature passed a bond issue of $2.5 million to complete the Roosevelt Coast Military Highway. After World War I, the United States military establishment was concerned about defending an inaccessible coastline, and supported this bond measure. The era of long-distance automobile touring exploded in the 1920s, adding impetus to the completion of the coast highway. The road, and various small bridges, were constructed over a twenty-year period by the different counties, ultimately uniting the disparate highway sections. In 1931, Lewis A. McArthur suggested that the name of the Roosevelt Coast Military Highway be changed to the Oregon Coast Highway to distinguish it from other national roads of the same name. By 1932 there were roughly 400 miles of highway completed between the Columbia River and the California border.[1]

In 1932 the highway was yet to be entirely connected. Five channels in the southern half of the state, Coos Bay, Umpqua River, Siuslaw River, Alsea Bay and Yaquina Bay, were crossed by ferry service. Soon after the highway was completed, tourist travel across these channels increased, and it became apparent that the ferries were inadequate to carry the growing volume of traffic. The State Highway Commission referred to the ferries as a "barrier to the growth and development of the Oregon coast region."[2]

Even before the completion of the highway it was assumed that these major crossings would be bridged. The state contemplated building one bridge per year after the Rogue River Bridge at Gold Beach was completed in 1932. In 1931 chambers of commerce, community clubs and other residents of the central and southerly coastal areas organized the Oregon Coast Highway Association, which became the regional chamber of commerce. This group encouraged the State Highway Commission to construct another bridge, but because the country was in the midst of the Great Depression there was little funding for such a project.

In June 1932, the Oregon Coast Highway Association organized a meeting at Waldport to discuss plans for constructing the final bridges. Ex-Governor Norblad proposed building three bridges as a means to create a market for lumber production in the area. Sam Dolan, an instructor in engineering at Oregon State College, suggested charging tolls on the bridges as a means to help them pay for themselves. This idea was not greeted warmly, but it was decided that with popular support tolls might be necessary. The Highway Associaton decided to encourage the state to appeal to the Reconstruction Finance Corporation for funds.

The RFC was a Hoover Administration relief program established by Congress in 1932 to assist banks, railroads and other major businesses. The stock market had crashed on October 24, 1929, affecting the lives of millions of Americans. President Hoover believed that government should not provide relief for the jobless. Franklin Delano Roosevelt, Governor of New York, was opposed to Hoover's beliefs. Roosevelt stated: "The country needs, and unless I mistake its temper, the country demands bold, persistent experimenation." On March 4, 1933 Roosevelt took office as president. Before approval of RFC funding for the coast bridges, administration changes cancelled the Reconstruction Financing Corporation. An application was then submitted to President Roosevelt's Public Works Administration program, for assistance to build the Oregon coast bridges. Roosevelt developed the National Recovery Act. The bill's main objective was to provide jobs for workers and establish a national pattern of maximum hours and minimum wages. State Bridge Engineer Conde B. McCullough explained the department's role at the time:

> When the opportunity of securing federal financing for the structures arose no planning on any of the bridges except for the Alsea Bay Bridge at Waldport had been done. The force of designers was more than doubled, and a night shift organized. After six months of intensive work, plans and specifications were completed.[3]

The total estimated cost of the coast bridge project was $5,602,000. The original agreement with the PWA stipulated that the federal government would grant the state $1,402,000 and loan the state $4,602,000 through the sale of bonds. The state decided to sell the bonds on the open market, saving on interest rates, and the federal government agreed. Within the state the question of tolls had not been resolved. It was estimated that a carload of five people would pay $4.00 in tolls to drive from Coos Bay to Newport and back. Increased highway revenues gave the state new confidence in its ability to pay back the loans, and the 1935 legislature abolished the issue of tolls on the coastal bridges.[4]

Many coastal residents believed that the bridges should be constructed of wood to assist the regions timber industries. The State Highway Commission considered constructing the bridges of wood, but found it impractical for the region. The high winds and damp salt air of this maritime environment would cause maintenance costs to run too high, and a few of the spans would be too long for a successful wooden bridge. At a highway commission meeting in Portland lumber interests agitated for the use of wood on the coastal bridges. McCullough believed that their pressure could delay the federal funds, causing them to be directed to another state project. Local residents feared the loss of federal funds, along with the benefits of jobs, so local chambers of commerce voted support the state in its plan for steel and concrete bridges. The amount of wood required for the falsework for the construction of steel and concrete bridges was nearly as much as if the bridges themselves were made of wood. The federal government granted final approval of the plans, and in the summer of 1934 contracts were awarded for the construction of five steel and concrete coastal bridges.[5]

One purpose of the coastal bridges project was to provide jobs for people unemployed by the Great Depression. The project accumulated over 2.1 million man hours. Additionally, the project benefitted Oregon industries by consuming 16 million board feet of lumber, 54,000 cubic yards of sand, 110,000 cubic yards of gravel, and 182,000 barrels of cement. it was expected that future revenue from tourism along the highway would increase greatly, to the benefit of both state and region. After construction of the bridges tourism jumped 72 percent in one year.[6]

The completion of the five Oregon coast bridges was a significant milestone in Oregon transportation history. These erection of these structures culminated twenty-two years of Oregon Coast Highway construction. Concrete was the primary construction material and was used for its climatic durability and for its ability to take any shape. These bridges represent classic examples of the Art Deco style, which was a popular design style of the late 1920s and 1930s.

The graceful symmetry of the bridges harmonize with the landscapes of the estuarine environments that they were designed for. Ornamental pylons and spires, gothic piers, spandrel brackets, arched railings, and landscaped waysides were utilized to make the bridges aesthetically pleased. Despite the depression, architecture of the day tended towards stream-lined decoration and finely crafted ornamentation. Such work was an artistic expression of optimism in a period of austerity. Amidst great fanfare, official dedications were held. There were christening ceremonies and bands, Coast Guard demonstrations and boat races--and even baby parades were scheduled to celebrate this important transportation milestone for the state of Oregon.[7]

Plans and specifications for the Alsea Bay Bridge were completed in the summer of 1933 by the state bridge engineers. To clarify their work Conde B. McCullough wrote:

> This department does not employ a consulting architect but has attempted as best it can to develop the architectural as well as the engineering side of design. Many of the designers employed in the Bridge Department have had considerable architectural training, and special emphasis is placed on this feature in the selection and development of the designing room personnel.[8]

The contract was awarded as a special joint venture agreement on April 26, 1934, to the firms of Lindstrom & Feigenson, Parker & Banfield and T.H. Banfield, both from Portland, Oregon. Total cost of the structure, including right of way, location surveys, field engineering and contract items amounted to $778,260.73. The original estimate of $685,040.00 was readjusted because it was "necessary to make several expensive revisions to foundations on this job."[9] The bridge was Project No. 982 with the Federal Emergency Administration of Public Works.

DESIGN AND CONSTRUCTION

Alsea Bay Bridge is the only one of the five PWA bridges, constructed entirly of reinforced concrete. It is located on the Oregon Coast Highway at Waldport. The bridge has a navigational clearance of 70', with a total length of 3,011'.[10] It spans the mouth of Alsea Bay and is a half-mile from the Pacific Ocean. The width is 31' with a 24-foot roadway and two 3'-6" sidewalks.

From the north, an approach viaduct 114' long leads to three 150-foot deck arches keyed to reinforced concrete piers. The main central spans above the river channel consist of three through tied arches with lateral bracing between the arch ribs. These arches are 154', 210' and 154' long. South of these spans are three additional 15-foot deck arches, followed by thirty-two deck girder approach spans totaling 1,460', the last crossing the shallow portion of the bay to the south shore. Both deck arches and tied arches are hinged at the crown and each skewback section. The construction of long span concrete arches on pile foundations was made practicable by the use of the Considere Hinge. This hinge is a short block of heavily reinforced concrete and of a relatively small cross-section, with an hour glass shape. Under the high stress placed upon it, it becomes flexible and allows the arch to adjust itself, to compensate for the effects of shrinkage and dead load deformation, both of the concrete and the piling. Before subjecting the arches to the load of traffic the hinges are encased in concrete and rigidly fixed.[11]

In the early twentieth century, French engineers were the pioneers in concrete-arch bridge construction. Their innovative techniques were, for the most part, unaccepted in the United States. "McCullough was one of the few to utilize these new methods, and the first American engineer to introduce precompression of arches through use of hydraulic jacks at the crown hinge. In 1931, he designed the first reinforced concrete tied arch in the Pacific Northwest over Wilson River on the Oregon Coast Highway near Tillamook.[12]

The central span of the three through tied arches 210' in length, rising 50 feet above deck, flanked by two, lower 154-foot arch spans. This three-arch series uses a concrete encased structural steel tie which serves as the bottom chord of the arches. The deck and chord are supported by the arch through its use of deck hangers attached to the floor beams. This permits the use of slender piers, since horizontal load bearing thrust is relieved by the tied arch components. Lateral bracing between the arch ribs serves to stabilize horizontal movement caused by high wind velocities. McCullough's original plans were modified to accommodate the War Department, which objected to having only one marine opening under a single deck arch. In the revised plan, he provided three marine openings and an increase in vertical clearance from 50 to 70'. The choice of three central arches in the Alsea Bay Bridge was dictated by the navigation requirements. In order to avoid long spans and still maintain horizontal and vertical clearances that were mandated, it was necessary to use the tied arch over the navigable channel. Concrete was the only material considered for this bridge because of the excessive maintanance costs for exposed steel construction on coast locations. Alsea Bay Bridge is constructed entirely of reinforced concrete with 72,000 linear feet of piling, 20,000 cubic yards of concrete, and 1,000 tons of reinforcing steel used in its construction. The sand for the concrete mix came from Yachats.

Decorative elements of the structure include curved spandrel post brackets which flair out and connect with the railing posts. Recessed gothic arches are articulated in the handrails mimicking the gothic arches of the piers and bents. Every fourth post in the railing is doubled and exhibits a shield shaped embellishment, with recessed triangle. The single posts share this docuration also. The railing is very rhythmic and pleasing to behold. Bents are fluted and tiered in the Art Deco style. The curtain walls are stepped towards the center of the spans and feature a raised double rectangle motif above the bents. The piers supporting the main spans have tiered and fluted shafts that connect with a gothic arch below deck. Both north and south ends of the approaches feature concrete entrance pylons approximately 17' high, with pilaster facing and sunburst motif scoring at the tip. Railings connect to the pylons at both ends of the bridge. Tiered spires accentuate the portals of the tied arch spans, matching the 36-foot height of the two lower arches. Each concrete spire is topped with a 15-foot, tapered timber of Port Orford cedar, "free from knots", as required by construction specifications. The railing and bridge deck widens the full 210' of the central spans. Balconies with solid curved railings introduct hte wider bridge deck. The designs were enhanced by high quality handworked detail and finish to the concrete surface. All exposed concrete surfaces were rubbed with carborundum to finish the surface and remove falsework lines. Plazas at the south end of the bridge have stairways on either side leading to the beach, allowing visitors to enjoy the gothic-arched colonnades created with the bents and piers. Arched railings are connected to the entrance pylons by a solid parapet wall. A simple medallion is placed on this solid concrete wall on either side of the pylons. Alsea Bay bridge was the third largest in size and cost of the Oregon coast bridge spans.

The overall appearance of Alsea Bay Bridge is one of grace, rhythm and harmony. It is the focal point in the scenic backdrop of the Waldport community, providing height, dimension and aesthetic qualities to the bay crossing. At the dedication ceremonies on May 9, 1936, R.H. Baldock represented the Highway Department and said that McCullough's bridge designs were "set like jewels in a chain of incomparable beauty" and their foundations "have been built to withstand the winds, the currents, and the tides of the centuries."[13]

The Oregon coast's picturesque arched bridges, a total of thirteen, are related in terms of geographic location, period, materials and style of construction. Some of McCullough's best examples of bridge construction are along the Oregon coast in what has been referred to by bridge historian David Plowden, as the most interesting concentration of concrete bridges in America. McCullough's arched coastal bridges have achieved their recognition, not only because of their engineering attributes, but because they are well-integrated into the grandeur and feeling of this coastal environment. To residents and visitors alike, these magnificent structures have become a vital component of the natural coastal resources. Each of these bridges were designed with the boldness of industrial sculpture, and yet the delicacy of fine art. They complement and enrich, rather than distort and intrude upon, the spectacular and even the minute features of their Pacific setting.[14] McCullough carried forward the Oregon concept, established with the building of the Columbia River Highway, that good roads and the landscape should be harmonious. Alsea Bay Bridge is considered by some experts to rank among the finer examples of concrete bridges in

America, and may be the longest concrete span in North America--some say in the world. However these claims have not been verified.[15]

REPAIR AND MAINTENANCE

Maintenance records in the files of the Oregon Department of Transportation indicate that between 1936 and 1948 only $15.79 was spent on maintenance. Spalling of the hanger columns was noticed in 1946, caused by rebar corrosion due to the salt laden marine environment. By 1966 four hangers in the main spans were seriously spalling with reinforcing bar exposed. The floor beams were showing longitudinal cracks on the bottom face. The major use of wood, second to the falsework, is found in the pilings which are driven 40 feet into the sand, and on which the bridge now rests. In 1968 it was discovered that some of the supporting timber piles on the southern approach had been weakened by marine borer infestation, a parasitic pest similar to a barnacle. In 1972 active corrosion was noted in the foundations of the supporting piers, and an underwater inspection revealed that the footings were exposed, In 1976 the bridge was treated with a cathodic protection program which slowed the deterioration of the reinforcing bar. In 1982 bridge analysis indicated that the Alsea Bay Bridge would have to be replaced. Spalling on the underside of the deck had become so advanced that falling concrete posed a threat to boaters passing under the bridge. Between 1986 and 1989 the bridge has been inspected on a weekly and monthly basis. The bridge is now load restricted, prohibiting use by trucks in excess of 80,000 pounds. A 35 m.p.h. speed limit has been established. The Alsea Bay Bridge was the first major coastal McCullough bridge to be considered for replacement. Construction of the new bridge spanning the river east of the old bridge will be completed in August 1991, and the original Alsea Bay bridge will be demolished. An interpretive center at the southwest end of the bridge approach will be ocnstructed to document the original bridge, as well as the importance of coastal road development and pioneer settlement on the Oregon coast.

1991 UPDATE: REPLACEMENT OF THE ALSEA BAY BRIDGE

The hostile salt air environment at oceanside caused extensive damage to the old bridge at Waldport during the fifty-five years that it carried vehicles across Alsea Bay. After a long project development process, including the release of an environmental impact statement, public participation, and special studies, the Oregon Department of Transportation (ODOT), in the mid-1980s, decided against rehabilitating the old structure and chose instead to replace it with a new span. The national engineering consulting firm of Howard, Needles, Tammen and Bergendoff prepared a number of conceptual designs. A citizens' advisory committee assisted ODOT in the selection process. After evaluating many options, including cable-stayed spans, girder spans, deck arches and through arches, ODOT--with the Waldport citizens' blessings--decided to replace the old structure with a steel through-arch and reinforced concrete girder approaches, resting on Y-shaped piers.[16]

A ground-breaking ceremony took place on the $42.5 million project on July 25, 1988. General Construction Company of Seattle, Washington, was the low bidder on the 2,910-foot long structure, which includes a 350-foot steel center arch. The bridge's total width is 80' and accommodates four lanes of traffic, 6-foot shoulders, and 6-foot sidewalks. Plans called for the completion of the new bridge in August 1991, with demolition of the old span to be finished by the end of the calendar year.[17]

Innovations incorporated into the design of the new structure prevent or at least delay the disastrous effects of chloride penetration that had affected the old bridge. For example, all reinforcing steel was coated with epoxy to make it resistant to corrosion. Latex concrete formed the wearing surface of the road deck. A layer of concrete at least 4" thick, rather that the normal 1-inch layer, formed the outer covering of the piers, to keep reinforcing steel well away from the surface where moisture and corrosive salt air might penetrate. The special procedures employed on the Alsea Bay Bridge give it a life expectancy of between 75 and 100 years.[18]

On August 24, 1991, 1,500 people witnessed Oregon Governor Barbara Roberts dedicate the new Alsea Bay Bridge. She then lead the crowd across the span. Altogether, over 5,000 Oregonians participated in the day-long event that marked the opening of the new bridge, with sports activities, barbecues, street dances and fireworks.[19]

ALSEA BAY BRIDGE INTERPRETIVE CENTER

During the course of construction, workers also erected the Alsea Bay Bridge Interpretive Center at the southwest end of the new span. The bridge section of ODOT designed this wood and steel-roofed structure. A memorandum of agreement between the Federal Highway Administration, the Advisory Council on Historic Preservation, and the Oregon State Historic Preservation Office stipulated the construction of the $788,000 building as part of mitigation for destruction of the historic bridge.

Interpretive Exhibits, Inc., of Salem, was awarded a $95,000 contract to design and fabricate displays to be housed within the complex. These include exhibits about settlement along the Oregon coast and the development of transportation links, especially the Oregon Coast Highway and its 1930s bridges. In addition, the Waldport Chamber of Commerce located its visitors' center there. The interpretive center is under the jurisdiction of the Oregon Department of Parks and Recreation. It was dedicated and opened to the public on November 2, 1991.[20]

As part of the memorandum of agreement, portions of the old bridge were salvaged to be reused on and around the new structure. Four spires, originally placed on the 1930s bridge at the ends of the center group of three tied arches, were relocated to a wayside park on the west site of U.S. 101, at the north end of the new approach. Two of the original four Art Deco pylons that marked the entrances to the old structure, in particular those at the north end, will remain at their original location, in the wayside park, to show the route of the old span. The southern pylons were placed near the south end of the new bridge near the interpretive center.[21]

DEMOLITION AND REMOVAL OF THE OLD ALSEA BAY BRIDGE

Two of the three tied-arch spans of the old bridge were dynamited on October 1, 1991 and fell to the floor of Alsea Bay. Demolition of the structure, which had served as part of the route since 1936, began shortly after the new span opened. A remaining tied arch and north approach spans were dismantled shortly thereafter. The Conde B. McCullough-designed Alsea Bay Bridge cost $778,000 to build in the mid-1930s and $1,000,000 to tear down in 1991.[22]

Removal of the old Alsea Bay Bridge required preventive measures to minimize degradation of the estuary as required by the Oregon Division of Lands, the U.S. Army Corps of Engineers, and the U.S. Coast Guard. Debris from the structure was disposed of at a nearby landfill.[23]

The Alsea Bay Bridge of 1991 replaces a structure that was, as Conde B. McCullough once exclaimed, one of his "jewel-like clasps in perfect settings linking units of a beautiful highway"--a route that one fan called "the most remarkable ocean shore boulevard in North America." In the coming years, travellers and residents, alike, may well revere the new span as much as they did the old.[24]

ENDNOTES

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2. Oregon State Highway Commission, Twelfth Biennial Report, 1934-1936, p.15.

3. "History of Coast Bridge Program is Interesting," Coos Bay Harbor (North Bend, Oregon) May 28, 1936, p.1.

4. Oregon State Highway Commission, Twelfth Biennial Report, 1934-1936, p.17.

5. "Lumbermen to Meet to Protest Concrete for 5 Coast Bridges," Sentinel (Cottage Grove, Oregon), 7 July 1933; "North Bend Backs Bridge Engineers," Harbor (North Bend, Oregon), 6 July 1933; "Squabble Over Lumber Ties Up Five Bridges," Journal (Portland, Oregon), 9 July 1933.

6. Arlene Castle, and others, Yaquina Bay, 1778-1978 (Newport, Oregon: The Lincoln County Historical Society, 1979), pp.54-56.

7. Bill Calder, "Golden Anniversary," Oregon Coast April/May 1986, pp.45-49.

8. C.B. McCullough, Letter to Aymar Embury II, May 6, 1938. General Bridge Files, Oregon Department of Transportation.

9. C.B. McCullough, Letter to R.H. Baldock, March 18, 1935. General Bridge Files, Oregon Department of Transportation.

10. The Oregon State Highway Department's Twelfth Biennial Report, 1934-1936 states that the bridge is 3,028' long. In August 1990, HAER architect Gretchen Van Dusen concluded that the width of the main piers were not included in the overall bridge length of 3,011', which is the length most commonly cited in various documents.

11. Oregon State Highway Commission, Twelfth Biennial Report, 1934-1936, p.55.

12. Carl Condit, American Building: Materials and techniques from the First Colonial Settlements to the Present (Chicago: The University of Chicago Press, 1968), p.258.

13. Ibid., p.56.

14. Ibid., p.256.

15. Maxine Banks, "Cultural Property Inventory and Request for a Determination of Eligibility, Oregon Department of Transportation, January 15, 1981."

16. Andy Booz, "Profile: Phil Rabb--Blending Form, Function, Public Ideas," VIA (Oregon Department of Transportation), September 1990; "Alsea Bay Bridge, Waldport, Oregon, Oregon Coast Highway (U.S. 101), Final Environmental Impact Statement," (Salem: Oregon Department of Transportation and Federal Highway Administration, 1986), pp.2F-5F.

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23. "Alsea Bay Bridge, Final Environmental Impact Statement," p.7F.

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ADDENDUM TO
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